

WHAT IS CLAIMED IS:

1. A displacement detecting apparatus comprising:

an illumination system which applies a
5 divergent light beam from a light-emitting device to the reflection scale provided on a measurement object which relatively moves;

said reflection scale which guides the light beam applied by said illumination system to a
10 direction different from said illumination system by at least two reflections; and

a light sensing device which detects an amount of a light beam reflected by said reflection scale.

15 2. An apparatus according to claim 1, wherein said reflection scale has an optical function of wavefront-splitting the divergent light beam from said illumination system into a plurality of light beams and overlaying the plurality of wavefront-split
20 light beams at a predetermined position.

3. An apparatus according to claim 1, wherein said reflection scale has an optical function of wavefront-splitting the divergent light beam from
25 said illumination system into a plurality of light beams and overlaying the plurality of wavefront-split light beams on a detection surface of said light

sensing device.

4. An apparatus according to claim 1, wherein
said reflection scale is a roof type reflection
5 element formed by opposing two reflection surfaces at
a predetermined angle.

5. An apparatus according to claim 4, wherein
said reflection scale has a plurality of roof type
10 reflection elements, each identical to said roof type
reflection element, arrayed in a predetermined
direction.

6. An apparatus according to claim 5, wherein
15 said reflection scale having said plurality of roof
type reflection elements, each identical to said roof
type reflection element, arrayed in the predetermined
direction is formed by a metal reflection surface,
and a reflection area thereof is a surface reflection
20 type mirror.

7. An apparatus according to claim 5, wherein
said reflection scale having said plurality of roof
type reflection elements, each identical to said roof
25 type reflection element, arrayed in the predetermined
direction is formed by a metal reflection surface,
and a reflection area thereof is a surface reflection.

8. An apparatus according to claim 7, wherein
said reflection scale having said plurality of roof
type reflection elements, each identical to said roof
type reflection element, arrayed in the predetermined
5 direction is an internal reflection type mirror made
of a transparent material, and has cylindrical
surfaces on the light beam incident and exit surface
sides.

10 9. An apparatus according to claim 5, wherein
said reflection scale having said plurality of roof
type reflection elements, each identical to said roof
type reflection element, arrayed in the predetermined
direction is formed such that all angles defined by
15 reflection surfaces are equal to each other.

10. An apparatus according to claim 5, wherein
said reflection scale having said plurality of roof
type reflection elements, each identical to said roof
20 type reflection element, arrayed in the predetermined
direction is formed such that angles defined by
reflection surfaces continuously increase/decrease
from a central portion to a peripheral portion in an
array direction of said roof type reflection elements
25 in said reflection scale.

11. An apparatus according to claim 5, wherein

said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

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12. An apparatus according to claim 11, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction, and a discontinuous portion has a substantially nonreflection characteristic.

13. An apparatus according to claim 4, wherein said reflection scale is formed such that a ridge formed by joining surfaces of said roof type reflection elements forms part of an arc or ellipse.

14. An apparatus according to claim 13, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection type mirror.

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15. An apparatus according to claim 13, wherein said reflection scale having said plurality of roof

type reflection elements, each identical to said roof
type reflection element, arrayed in the predetermined
direction is formed by a metal reflection surface,
and a reflection area thereof is a rear surface
5 reflection type mirror.

16. An apparatus according to claim 15, wherein
said reflection scale having said plurality of roof
type reflection elements, each identical to said roof
10 type reflection element, arrayed in the predetermined
direction is an internal reflection type mirror made
of a transparent material, and has cylindrical
surfaces on the light beam incident and exit surface
sides.

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17. An apparatus according to claim 13, wherein
said reflection scale having said plurality of roof
type reflection elements, each identical to said roof
type reflection element, arrayed in the predetermined
20 direction is formed such that all angles defined by
reflection surfaces are equal to each other.

18. An apparatus according to claim 13, wherein
said reflection scale having said plurality of roof
25 type reflection elements, each identical to said roof
type reflection element, arrayed in the predetermined
direction is formed such that angles defined by

reflection surfaces continuously increase/decrease from a central portion to a peripheral portion in an array direction of said roof type reflection elements in said reflection scale.

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19. An apparatus according to claim 13, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

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20. An apparatus according to claim 19, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction, and a discontinuous portion has a substantially nonreflection characteristic.

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21. An apparatus according to claim 4, wherein said reflection scale is formed such that an envelope surface formed by ridges formed by joining surfaces of said roof type reflection elements forms part of a spherical surface.

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22. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof

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type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection type mirror.

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23. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection.

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24. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is an internal reflection type mirror made of a transparent material, and has cylindrical surfaces on the light beam incident and exit surface sides.

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25. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that all angles defined by reflection surfaces are equal to each other.

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26. An apparatus according to claim 25, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that angles defined by reflection surfaces continuously increase/decrease from a central portion to a peripheral portion in an array direction of said roof type reflection elements in said reflection scale.

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27. An apparatus according to claim 21, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

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28. An apparatus according to claim 27, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction, and a discontinuous portion has a substantially nonreflection characteristic.

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